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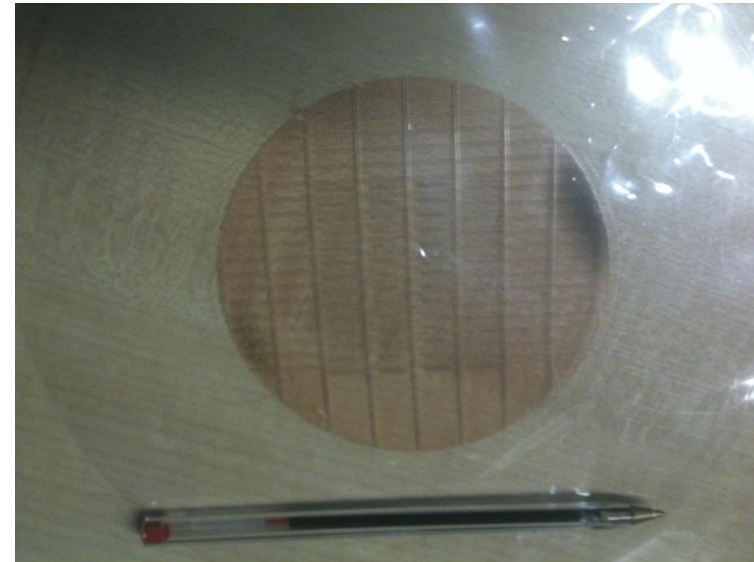
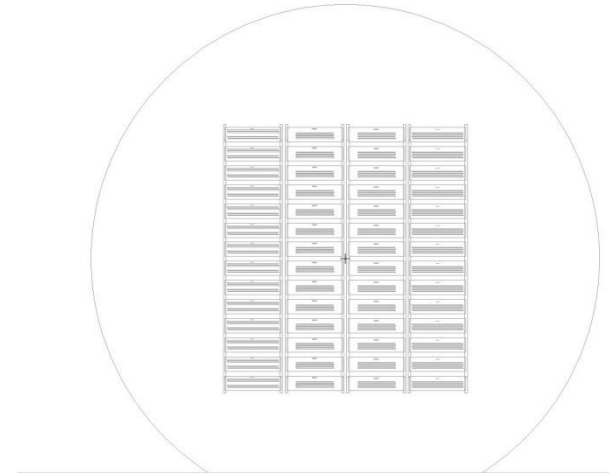
Wire Bonding Trials for 130nm ASICs

Andrew Blue & Fiona McEwan

On behalf of all Stave Module Building Institutes

- Several changes regarding wire bonding from the ABCn250 to ABCn130
 - 4 rows
 - “Worst case” bond lengths and angles increased
- Questions regarding ability of wire bonders within module/hybrid production sites to cope with new pad layout
- As a response from Tony’s request from last AUW, dummy samples were designed and fabricated at Glasgow to test the proposed bonding layout

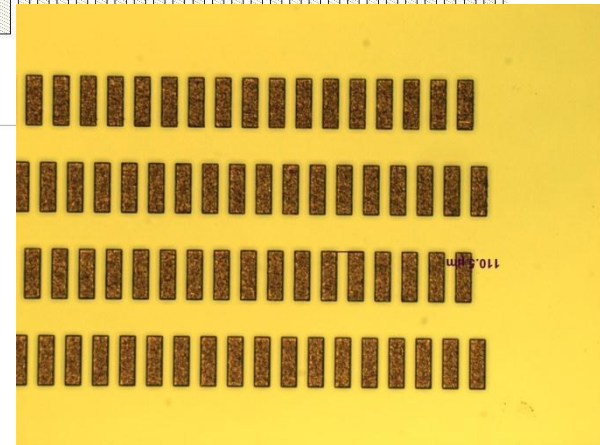
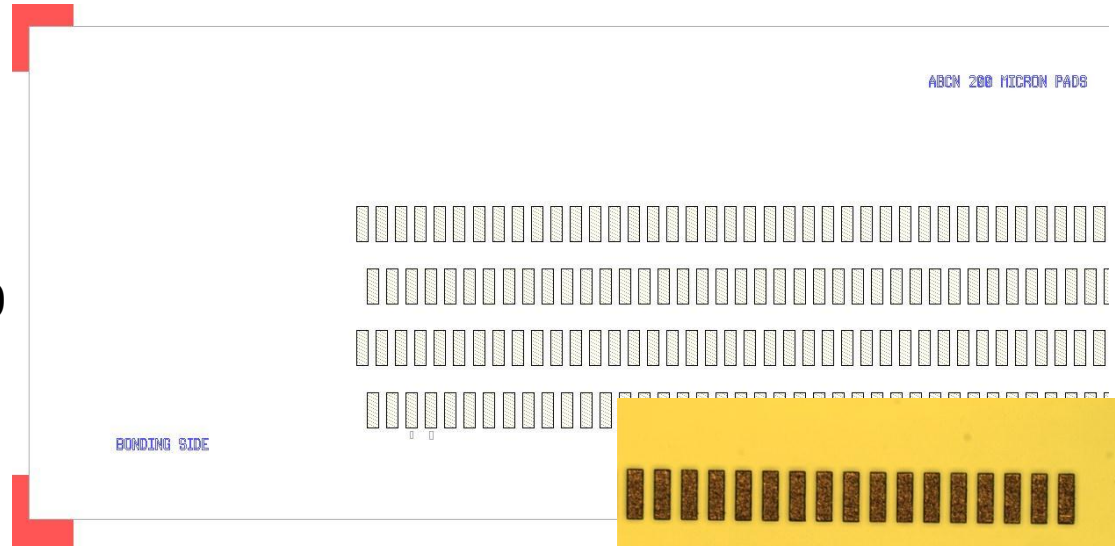
- 4 Designs were fabricated
 - 2 ASICS
 - 117um Bond pads
 - 200um bond pads
 - 2 Silicon Detector pads
 - With DC pads
 - Without DC pads
 - Glass wafers were fabricated at James Watt Nanofabrication Centre
 - e-beam for mask writing
 - Photolithography + Al lift off for sample fabrication



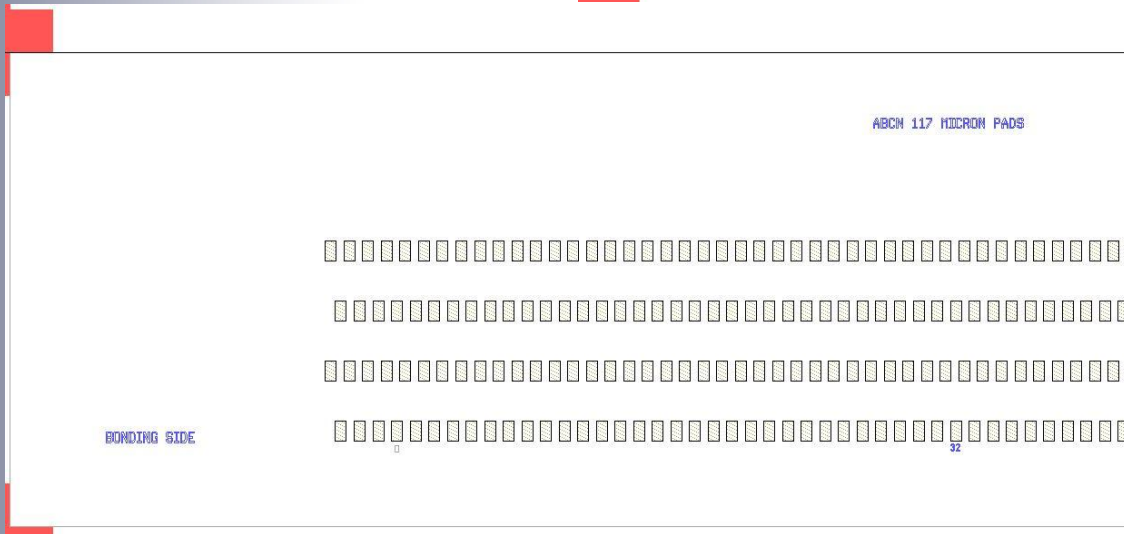
4 rows of 64 Pads
(+2 extra on each side)

Pads = 62x117um
62x200um
Pitch (in x)= 109um

200



117

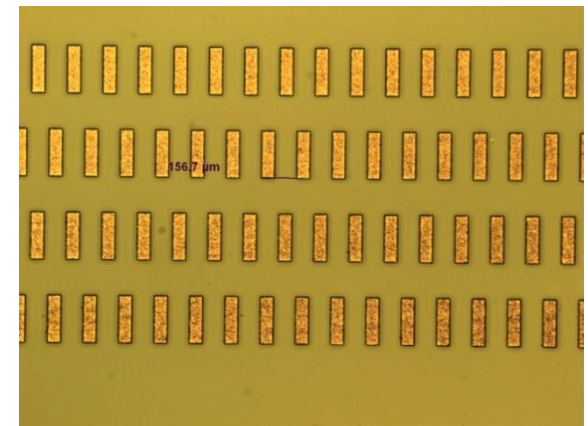
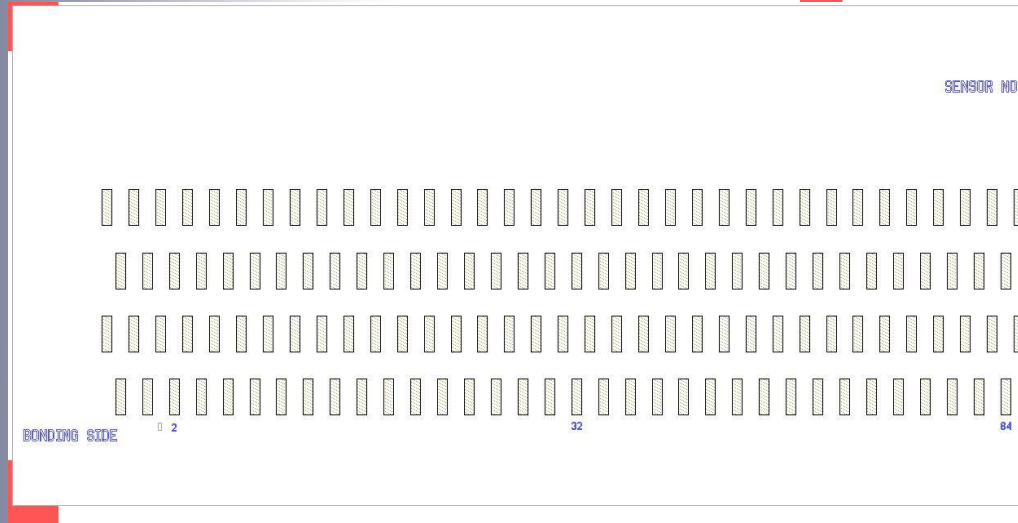
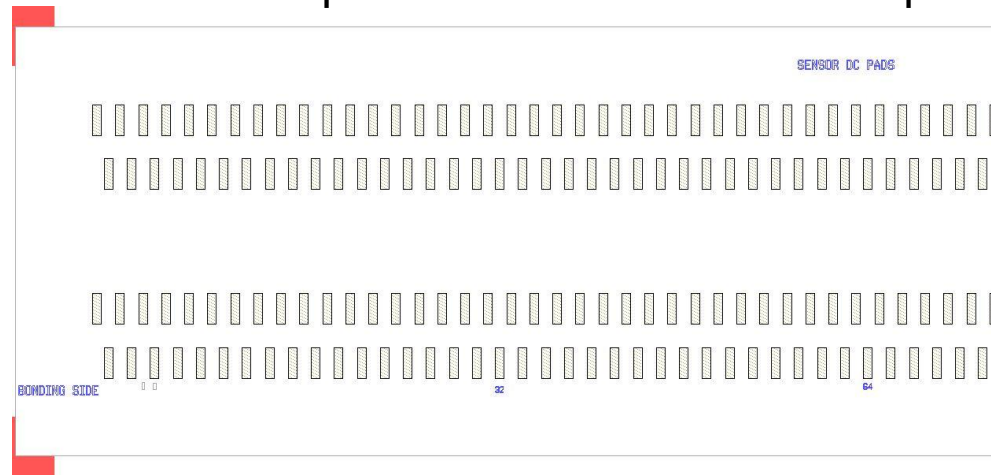


4 rows of Pads

Pads = 56x200 μ m

Pitch (in x) = 149 μ m

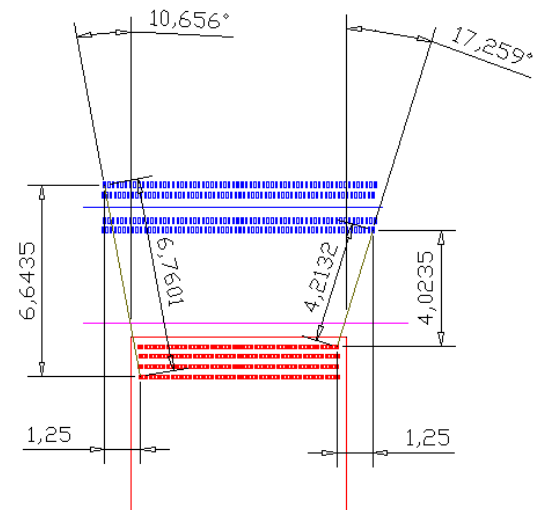
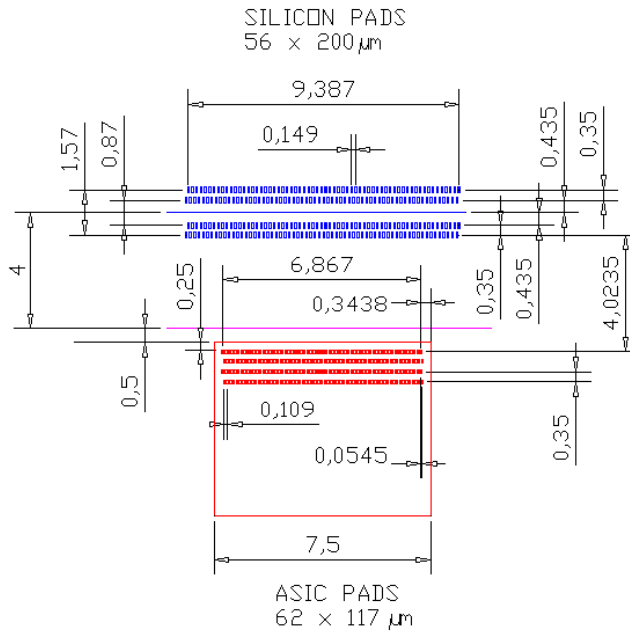
Gap mimics area used for DC pads



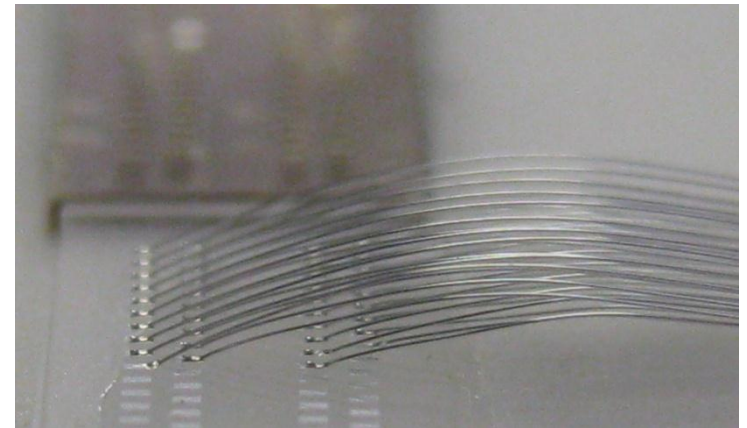
No DC pads

Sample Layout

7.5mm wide Asic

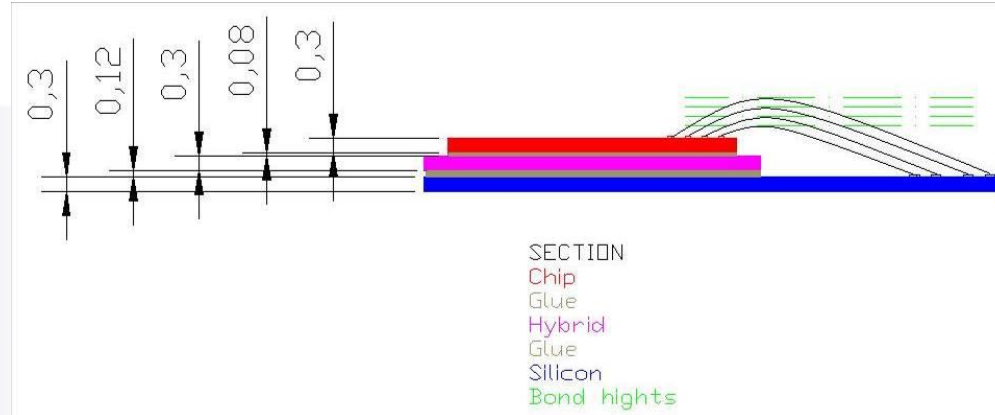


- Samples were given to
 - **Liverpool**
 - Cambridge
 - Glasgow
- **Santa Cruz** H&K BondJet 820 +deep access bond head
- Freiburg
- **Berkley** H&K BondJet 815
- DESY

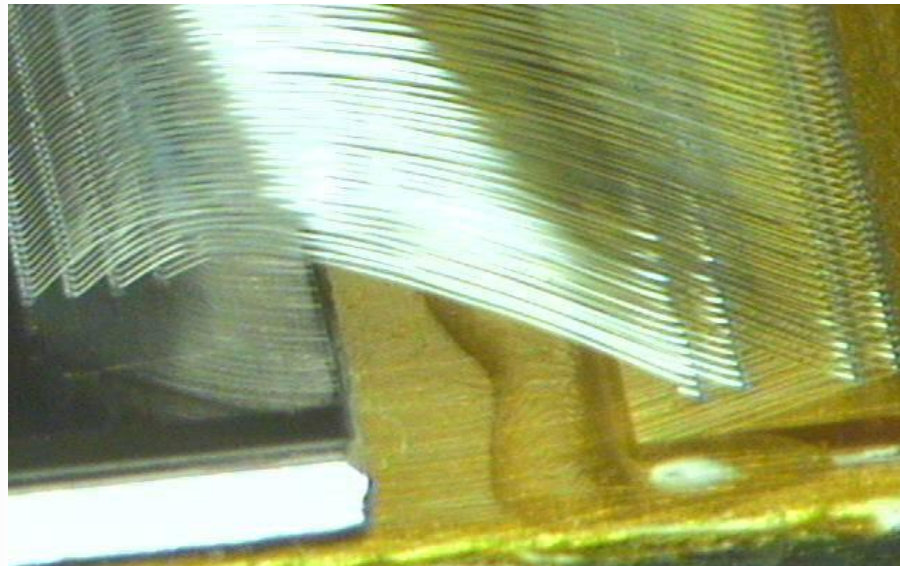


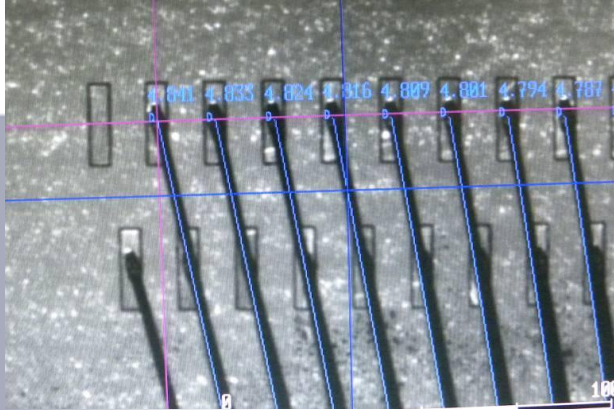
Glasgow

Liverpool - Bond tests at set height

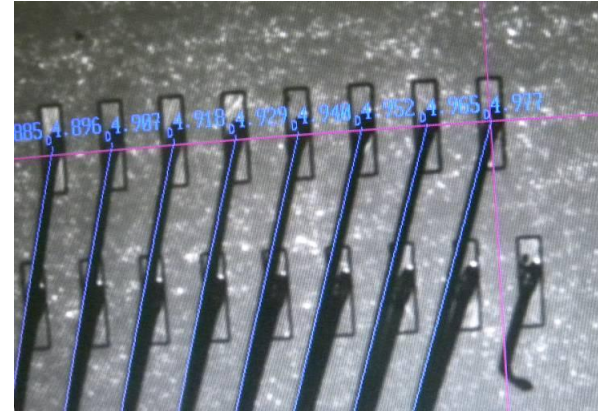


Bonded down from 800 micron at an angle of 16.5 degrees

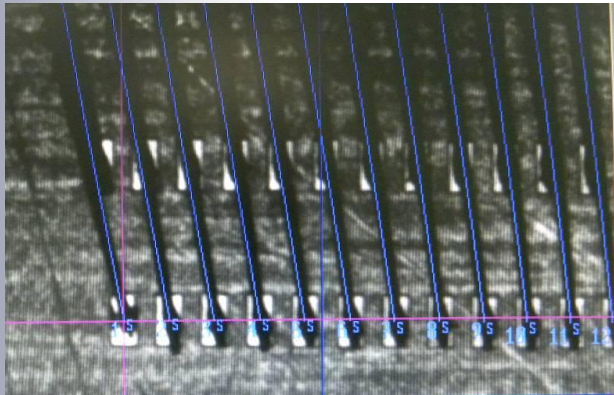




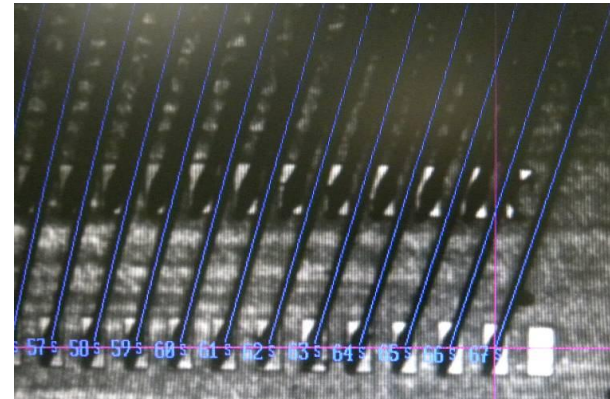
Destination



Destination



source



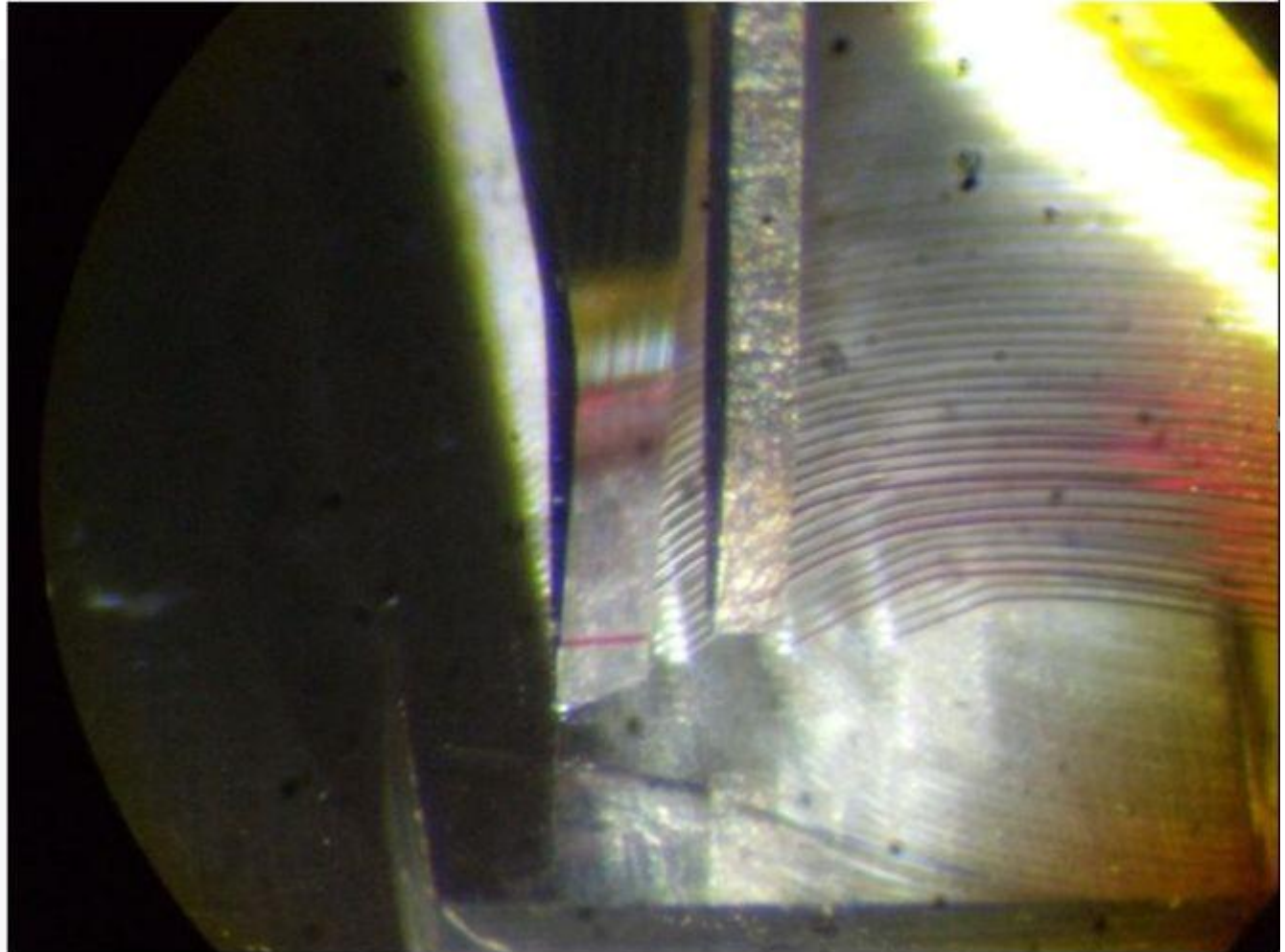
source

Photos show bond foot on source overhang the pads if the angle were greater

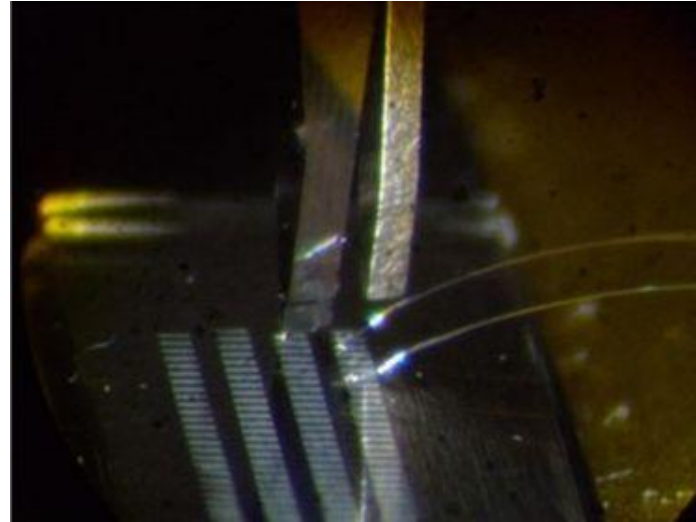
- possibility of shorts.

Wedge from the
“deep access”
bond head shown
next to the bond
wires done by Mike
at Liverpool

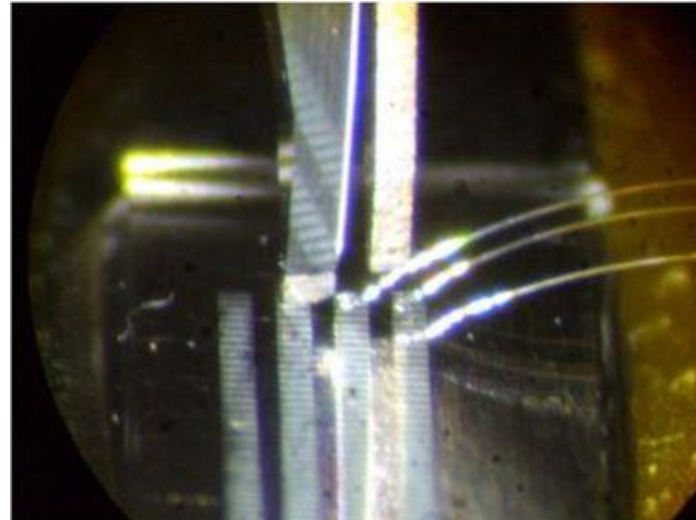
The wire clamp
would hit lower
loops
=> Loop shapes
are incompatible



Clamp clearance for the 1st
loop



Clamp clearance for the
2nd loop (3rd case is the
same)

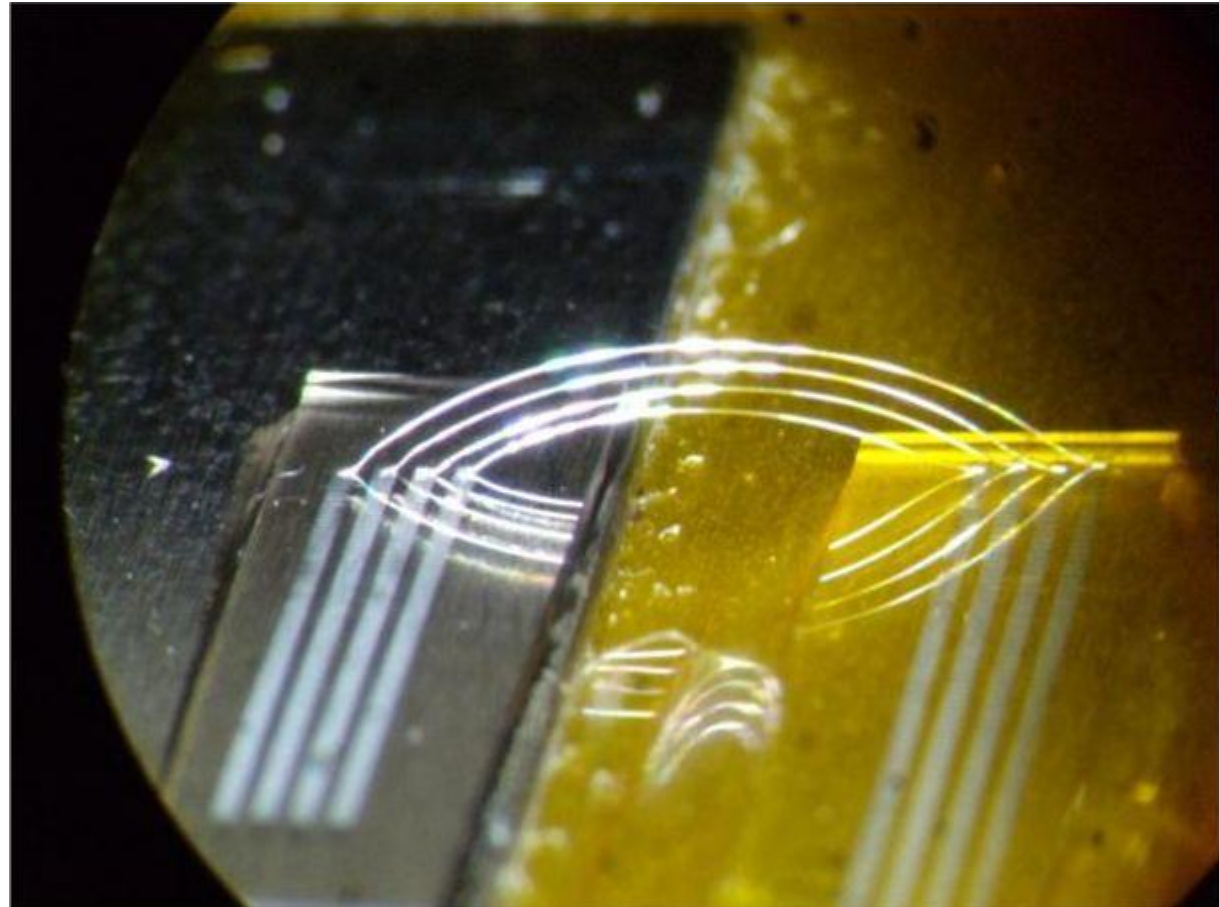


Loop shape we came up with that allows for:

- Clamp clearance
- Keeping the wire to wire distance (no “drop”) on the destination side)

Possible Issues

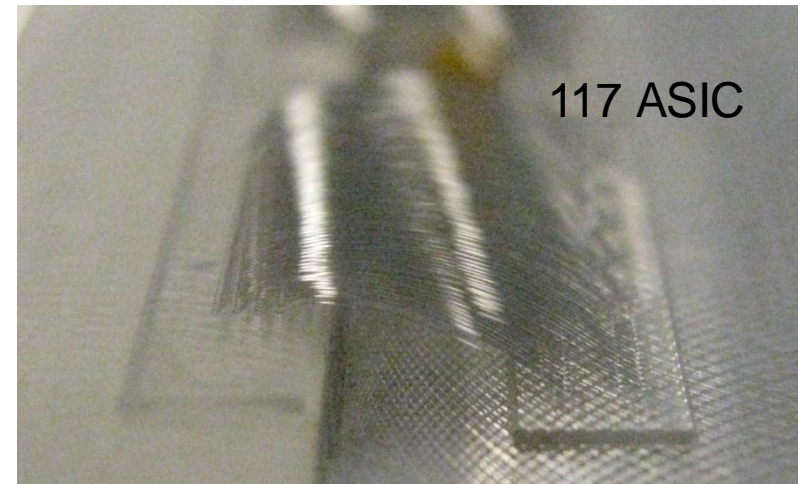
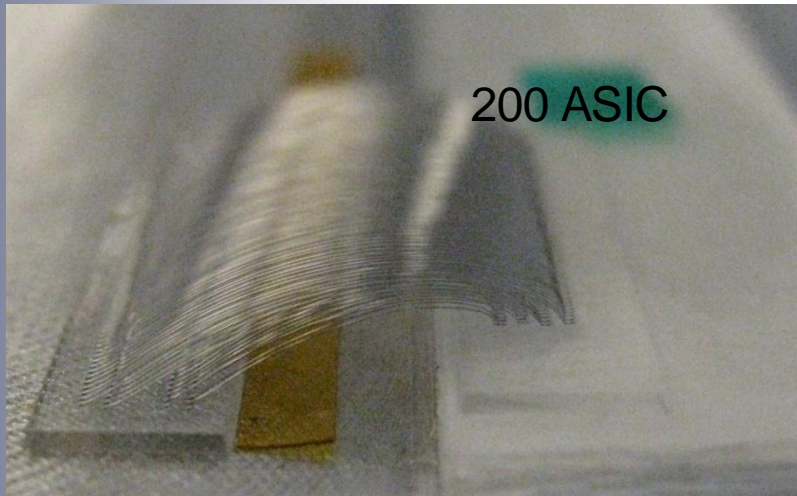
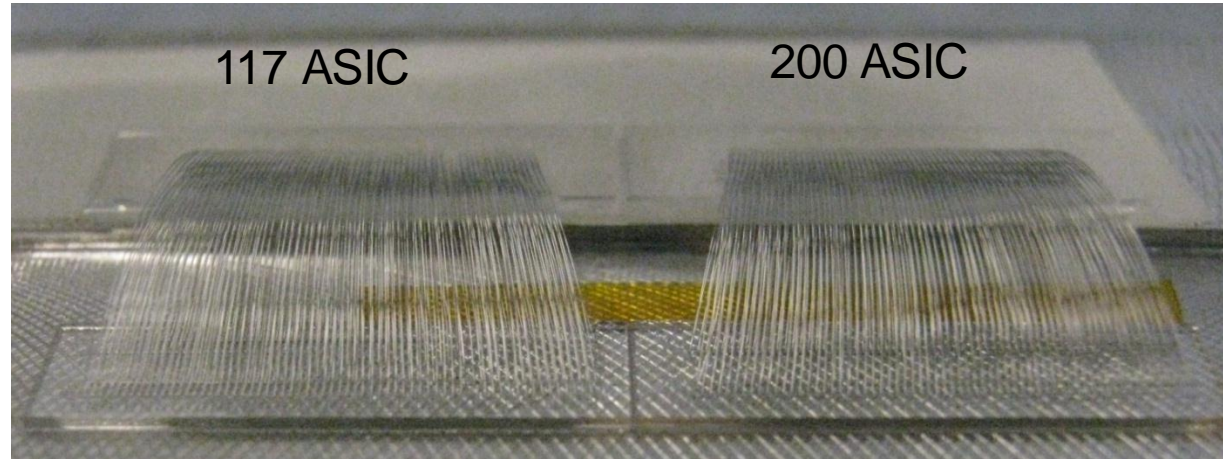
- There is reverse movement during loop formation that exerts a peeling force on the 1st bond
- (For further verification) We were not able to check the wire “sway” (maintaining the pitch distances), due to peeling pads



- Dummies were glued to Al piece with a step on it, simulating the chip/hybrid height with respect to the sensor
 - Height from sensor to chip ~ 770 μm
- Only 7.5 mm ASIC approach was taken (but expect very little differences wrt 7.9 mm)
- Manual placement of dummies was hard: ± 0.1 mm precision

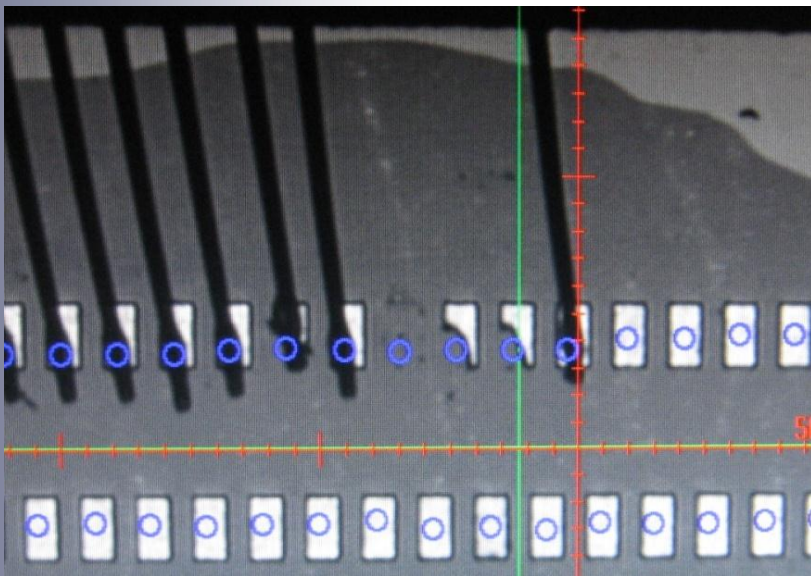
4 Row Bonding trials: Results

- Both 117 and 200 μm ASIC dummies were tried:
- Loop heights:
 - Inner row: 200 μm
 - 2nd row: 450 μm
 - 3rd row: 650 μm
 - Outer row: 900 μm
 - 85% exit angle

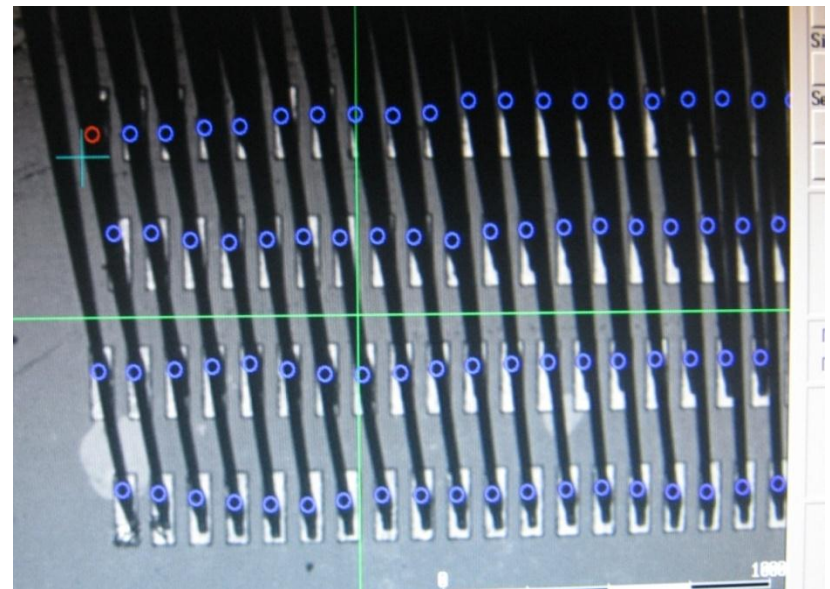


4 Rows Bonding Trials: Some Issues

- More force needed on 200 μm chip pads than on 117 μm chip pads
- 117 μm chip pads are ripped off if the bonder is not exactly in the center of the pad:

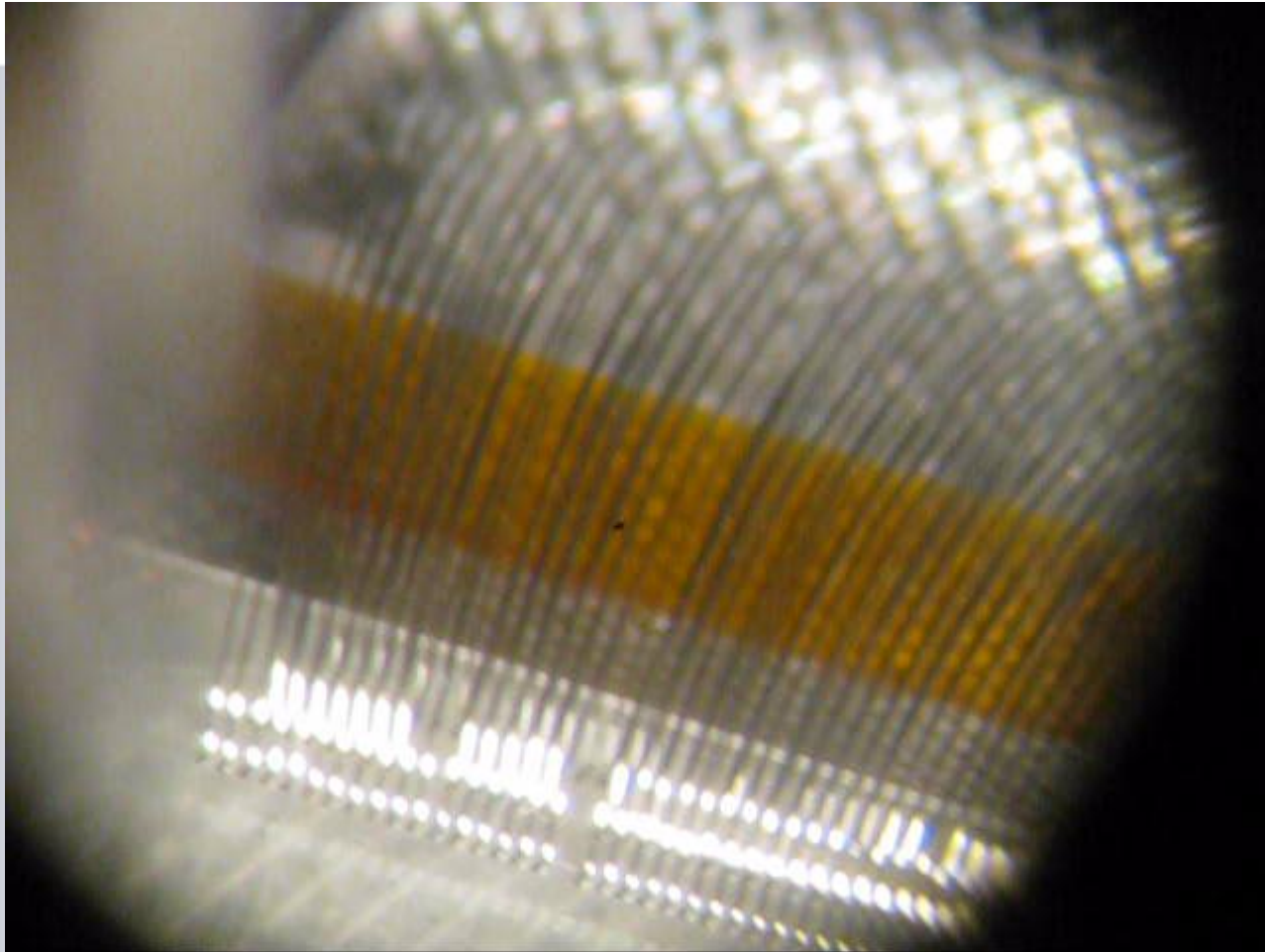


117 ASIC



200 ASIC

- All those issues do not relate to the 4 rows bonding itself
⇒ **4 rows bonding is possible at Berkeley**



- Test glass bonding pieces were designed and fabricated at Glasgow to test the proposed bonding layout for the ABCn130
- Bonding tests were made by
 - Liverpool (BJ 820)
 - Santa Cruz (BJ 820 + deep access bond head)
 - Berkley Labs (H&K BondJet 815)
- All groups showed indications that bonding would be possible
 - SC to look in to possible new bond head
- Moving to wider asic will also help
- Extra samples available so please contact me if interested
(andrew.blue@glasgow.ac.uk)